REVIEW

A decade in review: building on the experiences of past adolescent STI/HIV interventions to optimise future prevention efforts

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Sex Transm Infect 2006;**82**:431–436. doi: 10.1136/sti.2005.018002

The major purpose of this article is to systematically review and synthesise empirical findings from selected adolescent STI/HIV interventions conducted in the United States between 1994 and 2004. Specifically, the most current adolescent STI risk reduction interventions conducted in diverse venues, such as in the community, schools, clinics, and specialised adolescent centres (that is, detention homes and drug programmes) were examined for reported efficacy, and were assessed for programmatic and methodological strengths and weaknesses. Next, a subset of programmatic characteristics was identified that were associated with the efficacy of STI risk reduction programmes both within a particular venue, as well as across all venues. Finally, we discuss the research and practice implications of these findings for optimising future evidence based STI risk reduction programmes for adolescents in the United States.

All tables are available on our website at http://sti.bmj.com/supplemental

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Accepted for publication 31 January 2006

The risk of acquiring a sexually transmitted infection (STI) has become one of the most substantial and immediate threats to the health and wellbeing of adolescents in the United States.[1] When compared to other age groups, STIs disproportionately affect adolescents with prevalence rates among some subgroups reaching epidemic proportions.[2–4] Not only do STIs exact a significant toll on adolescents in term of morbidity, they also significantly impact society in terms of economic costs associated with detection and treatment.[5] Amplifying these concerns, however, is the increasing health threat posed by HIV.[6] In an era when an STI such as HIV can result in a fatal illness, AIDS, we have begun measuring the impact of sexual risk behaviours and their adverse sequelae in terms of number of deaths of adolescents and young adults from AIDS. Given that STIs have significant adverse health and social consequences for adolescents and society, preventing infection represents an urgent public health priority.[1 7 8]

In response to the personal and public health threat posed by STIs, over the past decade a number of sexual risk reduction programmes for adolescents in the United States have been published. These programmes were designed to modify STI/HIV associated sexual behaviours and psychosocial mediators (that is, attitudes, perceived normative influences, social skills) associated with STI/HIV acquisition, and have been developed, implemented, and evaluated in community settings[9] and schools,[10] clinical venues,[11] or other locations such as prisons, detention centres, or inpatient substance abuse treatment centres.

Several recent reviews have been reported on the effects of STI/HIV interventions for adolescents.[12–14] While informative, these reviews were limited by either being focused only on a particular subset of interventions (that is, interventions for sexually experienced adolescents only) or including only a small number of published interventions because of restrictive criteria related to meta-analytic techniques employed in the review (that is, the two reviews included only 16 and 20 interventions, respectively). Thus, there is considerable interest and need for a qualitative review which critically evaluates both the programmatic and methodological strengths and limitations of a larger, more representative sample of the published, evidence based STI prevention programmes for adolescents across diverse venues.

The purpose of this paper is to systematically review and synthesise, using a qualitative methodology, the empirical findings from a larger, more representative sample of adolescent STI/HIV interventions conducted in the United States in the past decade. Such a review and synthesis offers an opportunity to examine the reported efficacy of the most current STI risk reduction interventions conducted in a variety of venues, such as in the community, schools, clinics, and specialised adolescent centres (that is, prisons, detention centres, and drug treatment centres) in an attempt to identify relevant strengths or characteristics across programmes that successfully (that is, success is defined as a statistically significant ($p \leqslant 0.05$) reported change in behaviour that reduces risk of contracting an STI/HIV) contribute to reducing sexual risk taking in adolescents. Although programme effects are of primary interest, it is difficult, if not impossible,

Abbreviations: ASSESS, awareness, skills, self efficacy/self esteem, and social support; CYS, community youth service; ENABL, education now and babies later; IMB, information motivation behaviour; MAC, monogamy, abstinence, condoms; PCE, peer counsellor/educator; STD, sexually transmitted diseases; STI, sexually transmitted infections; YAPP, youth AIDS prevention programme

to completely disentangle programme effects from the methodology used to evaluate these programmes. Clearly, weak research designs and other methodological limitations can result in unreliable, imprecise, and invalid findings. Therefore, we assessed the programmatic and methodological characteristics of each reviewed STI risk reduction intervention, identified a subset of programmatic characteristics that were most probably associated with programmatic efficacy in terms of modifying adolescents' sexual risk behaviour within a particular intervention venue, as well as across all venues and, finally, examined the research and practice implications of these findings for optimising future evidence based STI risk reduction programmes for adolescents in the United States.

EVALUATION METHODS

Selection criteria

An electronic search of the professional literature was performed using online computer databases. The following databases were used: EBSCO Academic Search Premier; Alt HealthWatch; Medline; ERIC; Health Business FullTEXT; Health Source: Nursing/Academic Edition; Health Source: Consumer Edition; PsycARTICLES; Professional Development Collection; Ovid; and Psychinfo. To aid retrieval of relevant and sound studies, search filters were used for the included databases. Keywords used in the Boolean search included: ''adolescent,'' ''intervention,'' ''STD,'' ''STI'', STI/HIV and ''STD/HIV.'' Additionally, other published reviews of interventions for decreasing sexual risk taking among adolescents were used to locate other appropriate studies.[12–14]

Articles were reviewed to determine if they fulfilled additional criteria. Specifically, to be included in the review the studies had to be: (1) school, community, or clinic based interventions or interventions developed for special populations; (2) published in peer reviewed journals; and (3) published between 1994 and 2004. Studies were excluded from this analysis if: (1) people other than adolescents were included in the intervention (for the purpose of this review, ''adolescent'' was defined as anyone age 11–22 years), and (2) they did not incorporate behavioural or biomedical outcomes. Studies conducted exclusively among university students were excluded even if participants were late adolescents.

Evaluation criteria

A priori criteria were established for assessing the rigour of each study based on several sources. Firstly, criteria for assessing programmatic/methodological strengths were adapted from a previous review article reviewing sexual risk reduction interventions for women.[15] We identified 13 evaluation criteria from this source: (1) clear description of study site and sample; (2) specification of theoretical framework; (3) description of programme implementation; (4) description of intervention content and behaviour change techniques sufficiently detailed to permit replication; (5) description of content for control group treatment; (6) specification of length of follow up; (7) use of blinding procedures to prevent bias; (8) specification of retention rates reported for each study condition; (9) adherence to intention to treat principles in the data analysis; (10) assessment of pretest equivalence on sociodemographic and behavioural factors between study conditions; (11) clear description of data analytic techniques; (12) specification of a measure of variability for the designated effect size; and (13) sample size justification. We considered these criteria essential to a well designed, implemented and evaluated study.

SYNOPSIS OF EVALUATION

The literature search initially revealed a total of 910 articles that reported on data from a sexual risk reduction intervention. Seven hundred and forty eight of the citations were immediately eliminated because they did not meet the inclusion criteria or because they were duplicate citations. See table 1 for a summary of the search and elimination process.

This systematic review has identified 39 STI risk reduction interventions for adolescents that were conducted in four different settings (schools, clinics, community based, and specialised locations for particular populations such as juvenile detention facilities for incarcerated youth). Of the 39 interventions reviewed, 13 were conducted in schools,[16–28] 12 were conducted in clinics,[29–40] nine were developed for special populations and implemented in specialised locations (including jails, in patient treatment centres, etc),[41–49] and five were community based.[50–54] One intervention was implemented in a clinic setting and a detention centre facility so it will be discussed in both the clinic and special populations sections.[34] To provide a thorough review of each of the aforementioned studies, we provide information pertaining to the intervention programme, research methodology, and primary outcomes of each study in tables 2–9. A number of key findings emerge from this review and synthesis. Firstly, we present the findings within a particular intervention venue (that is, all of the findings for school based interventions are reviewed together, etc), followed by a synthesis of common strengths and weakness across all reviewed studies regardless of the intervention venue.

School based interventions (tables 2 and 6)

Three quarters of the school based interventions reported some behaviour change as a result of participation in the intervention. Reducing frequency of unprotected sexual intercourse was the most frequent outcome.[16 18 20 23–25 27] However, several studies did report a delay in initiation of intercourse and/or a decrease in frequency of intercourse.[19 24 25] One study found an increase in risk behaviour post-intervention.[22] The sexuality focused, school based interventions that were successful in reducing risk behaviour appear to be theoretically based, implemented by trained teachers or health educators, and include a variety of skills and knowledge building didactic and interactive activities.

Clinic based interventions (tables 3 and 7)

One third of the clinic based interventions included in this review reported no significant differences between the intervention and control condition in terms of behavioural outcomes.[30 31 34 39] Increases in condom use were the most commonly cited changes.[29 32 37 40] Several interventions decreased sexual initiation/sexual frequency.[32 33 35 38 40] Interventions that did not reduce risk behaviours tended to be single session,[30 31 39] or have no theoretical framework.[30 39] Characteristics of successful programmes included a focus on a single gender or ethnic group, HIV/STI education with skills building activities (that is, condom application), condom negotiation and sexual communication components, and personalised risk assessments.

Special population interventions (tables 4 and 8)

The majority of interventions targeting special populations reported some behavioural change as a result of the intervention. Reducing the frequency of unprotected sexual intercourse was the most common behavioural outcome reported by six of the 10 studies. However, reducing the number of sexual partners was reported in several studies,[42 47 49] as well as reducing the frequency of intercourse.[49] Two studies observed no behavioural change,[34 46], and one identified behavioural change for both the intervention and control group.[48] Although it is difficult to compare these interventions, given the diversity of the samples, a commonality across successful interventions was a strong theoretical

framework, implementation by trained research staff, and a broad content area delivered using a variety of didactic and interactive teaching methods.

Community based interventions (tables 5 and 9)

All of the community based interventions reported some behavioural change as a result of participation in the intervention. Reducing frequency of unprotected sexual intercourse was the most frequent outcome reported,[50 51 54] followed by reducing number of sexual partners[52] and sexual activity.[50 53] The most successful community based interventions were theoretically based, tailored to the target population, implemented by trained facilitators, and the content was diverse and delivered using a wide variety of methods.

STRENGTHS AND LIMITATIONS ACROSS INTERVENTIONS

A number of key findings emerge across all reviewed interventions, regardless of venue. Foremost, this review suggests that interventions with more success decreasing high risk sexual behaviour were those that specifically tailored and delivered the intervention to a particular subgroup of adolescents (for example, African American females).[32 36 40 50] Various researchers have supported and advocated for a tailored approach for STI/HIV risk reduction interventions, arguing that these interventions ultimately have the greatest likelihood of being successful.[55 56]

Secondly, the use of theory in intervention development and implementation was associated with improved STI risk behaviour outcomes. Social learning theory and social cognitive theory were the frameworks most consistently used in successful programmes.[16 18 24 25 32 35 40 50 51] These programmes incorporated modelling, skills building, and attempted to increase self efficacy with regard to safer sexual behaviour. Also associated with positive change was the information motivation behaviour (IMB) change theory.[20 40 47 49]

Finally, interventions that went beyond STI education to include an emphasis on psychological correlates of risk were effective at decreasing STI risk behaviour. For example, interventions that included broader based content, such as problem solving, capacity building, social skill building, and enhanced gender and ethnic pride, had the greatest impact on behaviour.[16 18 20 32 35 40] As Robin and colleagues note, ''Interventions more generally targeted toward increasing resiliency and competencies are emerging as promising approaches to reducing sexual risk behavior'' (p 18).[14]

What remains unclear is the relation between intervention duration and intervention efficacy. Some evidence suggests interventions with few sessions (less time intensive) are as effective at reducing risk as interventions with many sessions (more time intensive).[9] Conversely, other reviews indicate that duration may influence the effectiveness of programmes.[14] In our review, interventions with multiple sessions were some of the most effective (for example, Basen-Enquist *et al*,[16] Coyle *et al*,18] and Lonczak *et al*[24]) and least effective (for example, Weeks *et al*[27]). The only clear relation between duration and reduction of sexual risk behaviour was observed among clinic based studies: time intensive, multisession interventions were more effective than brief interventions.[32 35]

Additionally, determining consistency of programmatic effects across studies, even though most were randomised controlled designs, has been difficult given the variability in the reporting of programme results. For example, many studies did not report their effect size, or failed to provide sufficient statistical information to compute an effect size. Such variability restricts assessing comparability of findings between programmes. Moreover, lack of structured reporting of STI interventions reduces the level of certainty with which these interventions could be replicated.

Although we could not directly compare effect sizes between interventions across venues for a variety of reasons (for example, lack of structured reporting across studies), the evidence compiled in this review is encouraging as it suggests that there are effective interventions in each of the venues (that is, clinic, community, school, and specialised settings). In addition, our review and synthesis of results from adolescent STI/HIV interventions yields several observations that can inform and optimise the development, implementation, and evaluation of future STI/HIV prevention interventions for adolescents.

FUTURE DIRECTIONS OF STI/HIV PREVENTION INTERVENTIONS FOR ADOLESCENTS

Just as important as understanding the successes of effective interventions for adolescents, is the importance of identifying and confronting existing challenges to designing, implementing, and evaluating STI/HIV risk reduction interventions. By doing so, we hope to bring into sharper focus those areas that hold considerable promise for STI/HIV prevention for adolescents and, as such, warrant rigorous exploration. Thus, the following section highlights several areas where potentially significant improvements can be made with regard to future STI/HIV risk reduction interventions for adolescents.

Tailoring interventions to the target population

One particularly important point emerging from this review, regardless of venue, was that targeted interventions are markedly more effective relative to general or broad based interventions in terms of reducing STI associated behaviours. Targeted interventions acknowledge that adolescents are a heterogeneous mosaic of subgroups of different ethnicities/cultures, behavioural risk characteristics, developmental levels, sexual preferences, and gender differences. Because of the manifold differences between adolescent subgroups, developing interventions specifically for a restricted subgroup of adolescents may produce optimal results in terms of reducing risk associated behaviour. Thus, acknowledging that adolescents are not a homogeneous group is a critical first step in providing an impetus to design targeted and tailored interventions.

Target those behaviours that are most amenable to change

Across venues, the risk behaviour most susceptible to change was condom use during vaginal sex. A few programmes showed promising effects in terms of increasing abstinence or decreasing the number of sexual partners; however, these findings were markedly less common. Future intervention with adolescents, especially adolescents who are sexually active, should target behaviours, like condom use, that have been empirically demonstrated across a variety of adolescent subgroups and venues to be most amenable to change. Incorporating a focused approach targeting only specific areas of behavioural change, which are both reasonable and feasible for adolescents to accomplish, could result in a prevention strategy that amplifies STI programme efficacy, and lays the foundation for more sustainable programme effects over time.

Expand the scope of STI/HIV intervention programmes beyond the individual

For a variety of reasons, many of the studies reviewed focused primarily on the adolescent, whereas contemporary thinking in public health practice has shifted focus from the adolescent alone to the adolescent embedded in a complex ecology of peers, relational, familial, and cultural factors that constantly shape their STI associated risk and protective

behaviours.[57–59] It is possible that the next generation of STI risk reduction interventions will be developed using a multi-tier intervention framework. Specifically, such an intervention would focus on integrating individual based preventive counselling delivered, most likely, by a clinician, paediatrician, or school counsellor, who then ''refers'' the adolescent to community based prevention services. Such community based prevention services would be designed to extend, reinforce, and amplify the preventive message initially delivered to the adolescent using group formatted or social network intervention strategies that create an atmosphere conducive to and supportive of adolescents' adoption and maintenance of STI preventive practices.

Enlist the family as a behavioural change agent

Given the central role the family has in many developmental processes, including adolescents' family as a behavioural change agent could be particularly beneficial. Involving parents may be an especially important strategy to help delay adolescents' sexual debut, reduce frequency of intercourse, limit number of sexual partners, or support health promoting behaviours, such as protected sex. These goals may be achieved by fostering improved communication between parents and adolescents and intensified parental monitoring.[60 61]

Incorporate long term maintenance strategies into interventions

In general, this review found attenuation of intervention effects over the course of time. Specifically, programme effects were observed to decay (short term effects are significant, but longer term effects were no longer significant). Unfortunately, for behaviour change to be meaningful, it must be durable. Given the scope and complexity of influences that can affect adolescents' sexual behaviour, it is unclear whether short term STI/HIV preventive changes, observed as a result of participating in a risk reduction programme, *can* be sustained over protracted periods of time. Thus, it is necessary to develop and incorporate innovative prevention maintenance strategies to sustain, and if possible, amplify STI programme efficacy.

Incorporate biological outcomes as a measure of programme efficacy

Historically, interventions have relied almost exclusively on adolescents' self reported behaviour change to assess programme efficacy. Typically, and as was the case for almost all of the interventions reviewed, adolescents' reported their frequency of condom use or number of different sexual partners pre-intervention and post-intervention. Self reported data have been criticised as subject to potential reporting biases, inaccurate recall, and social desirability bias.[62 63] Recently, the use of newly developed DNA assays (polymerase chain reaction) to detect prevalent STIs has been advocated as a complementary measure for evaluating programme efficacy. Thus, future STI intervention studies, when applicable and feasible, should consider the utility of including biological markers as an objective and quantifiable outcome measure of programme efficacy.

Structured reporting of STI/HIV interventions

A limiting factor previously identified earlier in this review was the lack of structured reporting of STI/HIV interventions. Variability in the reporting of STI/HIV intervention trials severely limits comparability between trials. Moreover, the lack of structured reporting reduces the level of certainty with which such interventions could be carefully assessed, weighed against other interventions, and as important, reliably replicated. With the development and evaluation of increasing numbers of STI/HIV interventions for adolescents, structured reporting guidelines would provide a framework that may enhance interpretation of research findings by researchers, practitioners, and policy analysts.

Key messages

- Although many STI/HIV interventions for adolescents have been conducted in the past decade within the United States, the most current reviews on the effects of such STI/HIV interventions for adolescents only include a subset of the published adolescent STI/HIV interventions. Thus, this review critically evaluates a larger, more representative sample of the published adolescent STI/HIV interventions conducted in the United States between 1994 and 2004
- Despite the fact that we could not statistically compare effect size between interventions conducted in various venues for a variety of reasons (for example, lack of structured reporting across studies), the evidence compiled in this review is especially encouraging as it suggests that there are effective interventions (that is, significantly reduce sexual risk taking behaviour such as unprotected intercourse) in each of the venues included (that is, clinic, community, school, and specialised settings)
- From the 39 interventions reviewed, we have identified several features associated with effective interventions conducted within specific venues, as well as common characteristics of effective interventions across venues
- Our review highlights several areas were potentially significant improvements can be made with regard to future STI/HIV risk reduction interventions with adolescent populations

Measure cost effectiveness in STI/HIV interventions

In our current fiscal environment, it becomes imperative that we not only evaluate programme efficacy in terms of impact (for example, changes in behaviour, attitudes, norms, knowledge) and outcomes (for example, changes in morbidity) but also with regard to cost effectiveness. Although this is pertinent information for prevention scientists, the reporting of such information is limited for adolescent STI/HIV interventions. Such information is vitally important to programme planners, policy makers, and other people involved in the design and implementation of STI/HIV prevention programmes that are responsible for the judicious allocation of limited financial resources so as to maximise the number of adverse outcomes (for example, STI or HIV infection) averted through participation or exposure to an intervention programme .

Translate and disseminate effective STI/HIV interventions

As the findings from this review suggest, it is unlikely that any single STI/HIV intervention would be appropriate and equally effective for all adolescents given the heterogeneous nature of this population. However, encouragingly, this review has identified several effective STI/HIV prevention programmes for a variety of adolescents, delivered across multiple venues. The next challenge concerns moving beyond the intervention study and taking the necessary steps towards translating those interventions that have demonstrated programmatic efficacy in a particular venue, and with a particular group, into sustainable programmes that can be widely disseminated among similar venues and populations.

Ultimately, preventing STI/HIV infections in adolescents not only depends on the development and evaluation of innovative behaviour change approaches, but also on how effectively these interventions can be translated and integrated into self sustaining components of clinic practice, school curricula, or community programmes, particularly in those areas and among those adolescent populations most adversely impacted by the STIs and HIV epidemic.[64]

CONCLUSIONS

Although promising STI/HIV risk reduction programmes have been developed and evaluated across a variety of venues, including schools, community centres, clinics, and specialised locations such as detention facilities, future programmes delivered in all of these venues could be improved,[65] and many of the existing programmes reviewed could be programmatically and methodologically enhanced. However, optimising STI/HIV prevention efforts in the future will require prioritising the development and evaluation of innovative, theory based, empirically derived, and rigorously designed research specially tailored to the ethnic/cultural, gender, and sociodemographic characteristics of the target population. Thus, although the ideal of a single STI/HIV prevention strategy designed for all adolescents is appealing, based on the findings of this review, it is unrealistic, both in terms of feasibility and efficacy given the multicultural, gendered, and sociodemographically diverse adolescent subgroups in the United States.

CONTRIBUTORS

JMcDS was the primary author of the manuscript, and assisted in the conceptual design of the review and resulting manuscript, as well as searched for, identified, and reviewed the interventions meeting our search criteria; RRM searched for, identified, and reviewed the interventions meeting our search criteria, assisted with portions of the writing pertaining to search and evaluation methods, as well as reviewed and provided critical feedback of drafts of the manuscript; RJDiC assisted with the conceptual design of the review and resulting manuscript and reviewed and provided critical feedback of drafts of the manuscript.

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